ON-SITE REMEDIATION OF CONTAMINATED SOILS SAAD SITE: NASHVILLE, TENNESSEE UTILIZING A MOBILE THERMAL VOLATILIZER

Prepared for:

Kelly McCarty
EPA Region IV OSC
345 Courtland Street N.E.
Atlanta, Georgia 30365

Submitted by:

Paul Jayko
O.H. Materials Corp.
Findlay, Ohio

Gregory J. McCartney
Project Engineer

January 8, 1990

1.0 INTRODUCTION

U.S. EPA, Region IV, intends to treat approximately 10,000 tons of contaminated soil at the Saad site near Nashville, Tennessee. Analytical data provided by the EPA indicates the presence of benzenes, xylenes, toluenes, and other hydrocarbons. No RCRA wastes are noted.

OHM has developed an innovative process, for the removal of hydrocarbons from soils and sediments, which would be applicable to the Saad site. The processing equipment is contained on two semi-trailers and uses thermal energy to drive the process. The Mobile Thermal Volatilization System II (MTVS II) has been successfully used on several projects for the removal of various fuels and greases from silty clay type soils. The MTVS II is currently permitted in EPA Region IV.

2.0 MTVS II TECHNICAL APPROACH

The objective in the development of the Mobile Thermal Volatilization System (MTVS) was to design a technically-sound, regulatory-acceptable and economically feasible method for the treatment of contaminated soils. The design was limited to only non-halogenated hydrocarbon compounds which eliminates the need for a high-temperature afterburner and high efficiency acid gas scrubbing equipment.

2.1 TECHNICAL DESCRIPTION

The theory behind thermal volatilization consists of heating the soil to the temperature where the organic contaminant is vaporized and removed from the soil. The vapors are then passed through a twin cyclone to remove heavy particulate contamination and then through an afterburner to ensure complete oxidation to the harmless by-products of carbon dioxide and water. The resulting off-gas is then scrubbed of particulate matter before being emitted into the atmosphere through a clean combustion exhaust stack. The technical specifications for the MTVS II are contained in Table 2-1.

The thermal volatilization system consists of three major components: the primary chamber, the secondary chamber, and the air pollution control system. The primary chamber is a direct-fired, rotary kiln system utilizing a propane or natural gas fuel source, is capable of sustaining operating temperatures up to 1,200°F. Contaminated soils are introduced to the system by means of a variable speed screw conveyer, and travel concurrent to the direction of combustion gas flow.

The system operating conditions of temperature, residence time, excess oxygen and throughput and precisely controlled to achieve the desired soil discharge temperature of from 500°F to 1,000°F. The

required soil discharge temperature is dependent on the vaporization characteristics of the hydrocarbon constituents and the site treatment criteria.

The organic vapors are controlled by the secondary combustion chamber which has been designed for an operating temperature of up to 1,400°F and a gas retention time of 0.6 seconds.

The afterburner is constructed of mild carbon steel and insulated with 2 inches of ceramic fiber board insulation. A continuous emissions monitor for oxygen has been installed on the discharge duct of the secondary chamber to control combustion parameters and ensure complete destruction of organic vapors.

The air pollution control equipment consists of a hot cyclone which is used to remove the majority of the particulate matter from the gas stream and prevent particulate carryover to the secondary chamber. After the secondary chamber the gases are quenched in a stainless steel duct before passing to a patented venturi scrubber and mist eliminator. The cleaned gases are then exhausted from the system by means of an induced draft (ID) fan. The ID fan also contains fugitive emissions from the system by maintaining a negative draft on the entire system.

2.0 ON-SITE OPERATION

The MTVS units have been designed to be compact and highly mobile. The majority of the system (primary and secondary chambers, soil feed and discharge systems, diesel generator, control system and stack) is contained on a single 48-foot semi-trailer; the wet scrubber is mounted on a small utility trailer. The entire system requires an area of approximately 30 feet by 60 feet for the equipment with additional area required for material handling, ash storage, and parking.

The MTVS II does not require extensive external support in order to operate. If a natural gas or propane line is not readily available to supply the MTVS II, a local propane vendor can easily meet the operating requirements. The water requirements of the MTVS II can also be achieved with equal ease through either an existing water line or a local vendor. Electrical requirements can be met by utilizing existing electrical sources, or through the MTVS II's diesel generator.

Material handling requirements can be fulfilled by OHM. Our previous project experience gained from crushing and screening, as well as the use of specialized material handling equipment, will enable OHM to provide competent services in these areas.

2.3 SAMPLING AND ANALYSIS PROCEDURES

The waste feed pile will be analyzed to determine the initial and final concentration of contaminants or as otherwise designed and directed.

TABLE 2-1
TECHNICAL SPECIFICATIONS
MTVS II

System Design:

Maximum feed rate	20,000 lbs/hr.
Particle size	up to 3 inches
Optimal hydrocarbon content	1.0-2.5 percent
Design moisture content	15 percent
Soil discharge temperature	500-1,000°F
Primary heat capacity	10 mmBtu/hr.
Solids retention time	15-60 minutes
Secondary chamber temperature	1,400°F
Secondary chamber volume	260 ft^3
Secondary chamber heat capacity	10 mmBtu/hr.
Secondary retention time (min.)	0.6 seconds
Water requirements	12 gpm

Performance:

Design VOC destruction	99.9%
Particulate emissions	<0.04 gr./dscf

Soil Cleanup Quality:

Hydrocarbon content	< 50 ppm
Benzene	<0.1 ppm
Toluene	<0.1 ppm
Xylene	<0.1 ppm

3.0 SCHEDULE

OHM presently owns and operates two MTVS units. Scheduling of these systems is a function of equipment availability.

The schedule for obtaining regulatory approval for the MTVS will depend on the Tennessee DNR permitting requirements. Once all of the regulatory approvals are obtained and a project start date is determined, the unit will be mobilized to the Saad site. The system can be set up on site within two days of arrival. The unit and associated support facilities will be disassembled and removed from the site within three days of process completion. The MTVS II is operated on a 24-hour per day basis, and the production rate for the processing of soils typically ranges from 4 to 6 tons per hour. At this time, a duration of 80 days is estimated to complete material processing.

4.0 PROJECT COST

If requested, OHM will prepare a budgetary cost estimate to perform the volatilization of the contaminated soil. This cost will include mobilizing and demobilizing the equipment, management, labor, fuel costs, soil treatment, and analytical verification. Production rates and associated thermal treatment cost are dependent on soil characteristics.

The MTVS II is operated on a 24-hour-per-day basis, and the production rate for the processing of soils typically ranges between 4 tons per hour and 6 tons per hour. The thermal treatment cost typically ranges between $70 and $120 per ton, and is highly dependent on the actual level of contamination, moisture content, and decontamination criteria.

A one-time cost for mobilization, setup, teardown, and demobilization of the system is assessed, and is independent of the soil volume requiring treatment. This cost typically ranges from $20,000 to $40,000.

These costs and time schedules are entirely independent of any project material handling or conditioning.